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219/535

939664 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

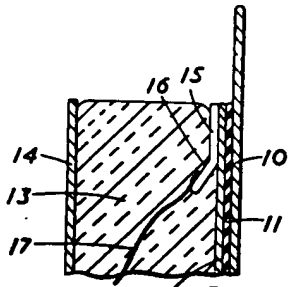

FIG. 1.

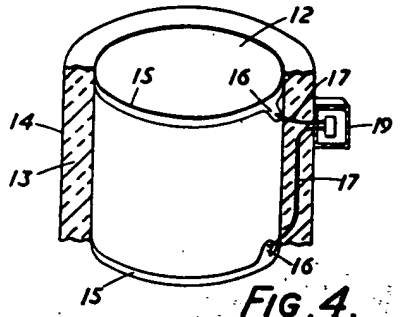

FIG. 4.

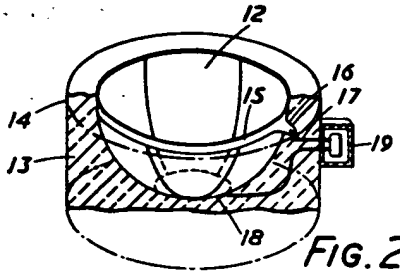

FIG. 2.

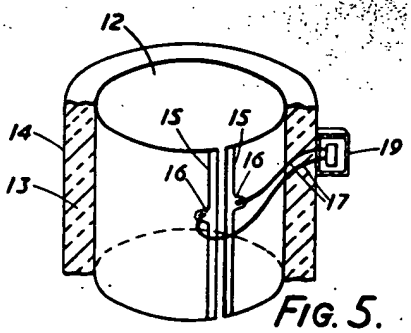

FIG. 5.

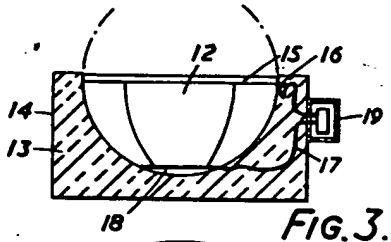

FIG. 3.

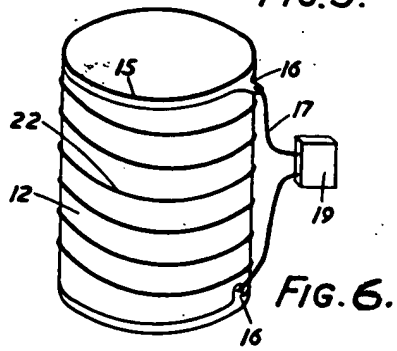

FIG. 6.

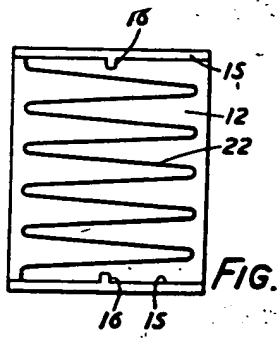

FIG. 7.

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939,664

PATENT SPECIFICATION

939,664

DRAWINGS ATTACHED.

939,664

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COMPLETE SPECIFICATION.

Improvements in Electric Heating Mantles.

We, ISOPAD LIMITED, a British Company, of Barnet By-Pass, Boreham Wood, Hertfordshire, and HANUS REIK, a British Subject, of 80 Windermere Avenue, Finchley, London, N.3, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electric heating mantles for surface heating.

According to the invention, we provide a heating mantle shaped to receive and surround a vessel, in which an electrical heating element comprising a woven metal wire mesh adapted to carry a heating current is arranged on or near the inner surface of the mantle, the mantle having an external lagging of heat insulating material.

Various embodiments of the invention will now be described in greater detail, with reference to the accompanying drawings, wherein:—

Figure 1 is a typical section of the side of an embodiment;

Figure 2 is a perspective view of an embodiment, broken open to expose the inside;

Figure 3 is a vertical section through the embodiment of Figure 2;

Figures 4 and 5 are perspective views of two further embodiments, broken open to expose the inside;

Figure 6 is a perspective view of a further, modified embodiment;

Figure 7 is a plan view of heating means for a further modified embodiment, before the heating means has been finally shaped to form a mantle.

Figure 1 generally shows how the invention is used in surface heating. The surface of the vessel to be heated is denoted 10, and may, for example, be the side wall of a glass of water. The heating surface 11 of the mantle, which is shaped to receive and surround the vessel, and is brought into contact with the surface 10 to be heated, is a thin layer of electrical insulation, behind which is arranged a heating element in the form of a woven metal wire mesh material 12. Behind the material 12, heat insulating lagging 13, for example asbestos, is provided, and the lagging is enclosed by a protective outer wall 14, which may be metal. Current is supplied to the heating element by means of a metal band 15, lugs 16 and conductors 17, only one lug and conductor being shown in Figure 1.

Figures 2 and 3 show how the invention is applied to a hemispherical heating mantle adapted to heat a vessel having a hemispherical bottom. The wire mesh material 12 is given the form of a hemispherical cup adapted to fit said hemispherical bottom. This is simply done by cutting the material into suitable sections (say 6 segments) and sewing these segments together with a wire of similar gauge to that used for weaving the original mesh material.

For enabling the current to be supplied to the heating cup a metal band 15 of material suitable for the required temperature is applied to the equator of said cup (i.e. substantially around the rim) and a collecting ring 18 is applied near the bottom of the cup parallel to said band. The actual spacing between said band 15 and ring 18 will depend on the current and densities desired, and the maximum current density which must not be exceeded. Said band 15 and collecting ring 18 are provided with conducting lugs 16, similar to the one which is seen in section in Figure 1.

This heating cup is then coated on the outside with lagging material 13 having a thickness of 2 to 4 inches, according to the size of the heating cup, and a suitable metal

[*Price* 4*s.* 6*d.*]

outer shell 14 covers the outside of said lagging. This metal shell 14 carries the junction box 19, to which conductors 17 from the aforesaid conducting lugs 16 extend.

In this and in subsequent embodiments the interior insulation 11 is not shown. When the surface to be heated is non-conductive, e.g. glass, the insulation 11 is not necessary, and the wire mesh material 12 itself may form the heating surface. However, insulation 11 will normally be provided both for general safety and to allow the heating of metal surfaces or of liquids.

Whenever the wire mesh material is given the shape of a surface of revolution, the current may be passed through it between axially opposite ends. Thus Figure 4 shows a mantle constructed for the heating of a cylindrical vessel. The shaping of the wire mesh material 12 is simpler in this embodiment than in the embodiment of Figures 2 and 3, since it need only be curved into a cylinder. Metal bands or rings 15 at the top and the bottom of the cylinder allow the heating current to be passed through the material 12, and bands 15 are connected, as in the previous embodiment, through conductors 17 to a junction box 19.

In an alternative embodiment, shown in Figure 5, a sheet 12 of the wire mesh material is bent to annular or cylindrical form but with its edges not quite in contact, and, instead of ring-shaped bands, straight collecting bars or strips 15 are applied to these edges. Other details of this embodiment resemble that of Figure 4.

In accordance with a modification of the invention a woven metal wire mesh material is employed, as above described, in the heating mantle, but an uninsulated resistance heating conductor or conductors is also employed. This is conductively attached to the wire mesh material by means of a wire or tape or other means, and follows a zig-zag, helical or other path suitable for heating the vessel or other surface to be heated. The heating current is passed through this heating conductor or conductors, and it will be seen that the wire mesh material will also carry some of the load, and thus the heat will be distributed more evenly.

Figure 6 shows how this modification may be applied to the device of Figure 4. Figure 6 shows the heating element, which consists of wire mesh material 12, and additional heating conductor 22 wound helically round the cylinder of material 12, and in conductive contact therewith. In this modification, the material 12 will be of greater resistance than that which would be used in the absence of conductor 22, so that the load will be shared between material 12 and conductor 22.

Figure 7 shows how the modification may be applied to the device of Figure 5, and shows the material 12 and additional heating conductor 22 before they are curved into the cylindrical form of Figure 5. The curving into cylindrical form is done so that conductor 22 and connecting lugs 16 are on the outside of the cylinder.

It will be understood that many variations of the invention are possible. Thus, the metal bands 15 for supplying the heating current to the material 12 may be formed by spraying metal onto the edge of the material 12. A great advantage of the invention lies in the fact that heating can be applied uniformly, and that, by the choice of suitable materials, high temperatures can be achieved under controlled conditions. Moreover, the heating elements described herein are more reliable than heating elements of conventional type in which failure at any point in a single heating conductor will interrupt the heating circuit.

One particular example of the woven metal wire mesh material consists of stainless steel wires, the gauge of the wires being 28 s.w.g. and the weave being 16 wires per inch. By varying the gauge and the spacing of the wires different loadings can be accommodated, varying for example between 100 and 3000 Watts p. sq. ft. (0.7 and 21 W.p.s.i.) in order to suit the dimensions and the voltage required.

WHAT WE CLAIM IS:—

1. A heating mantle shaped to receive and surround a vessel, in which an electrical heating element comprising a woven metal wire mesh adapted to carry a heating current is arranged on or near the inner surface of the mantle, the mantle having an external lagging of heat insulating material.

2. A mantle according to Claim 1, wherein the inner surface of the mantle is formed of insulating material immediately below which the heating element is arranged.

3. An electric heating device according to Claim 1 or 2, wherein the heating element is formed into a surface of revolution about an axis, means being provided for passing the heating current between axially opposite ends of said surface.

4. A mantle according to Claim 1 or 2, wherein the heating element is formed into an incomplete annulus, means being provided for passing the heating current circumferentially around said annulus.

5. A mantle according to any preceding claim, wherein the strands forming said wire mesh are uninsulated from one another.

6. A mantle according to any preceding claim, wherein means for passing the heating current through the metal wire mesh comprise a metal band or bands conduc-

tively attached to an edge or to opposite edges of the said wire mesh.

7. An electrical heating device according to any preceding claim, wherein a resistance heating conductor is conductively attached to the metal wire mesh means being provided for passing a heating current through said conductor, whereby the said wire mesh carries part only of the load, but serves to distribute the heat more evenly than would the conductor alone.

8. Heating mantles substantially as herein described with reference to the accompanying drawings.

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